

What is claimed is:

1. An image pickup lens comprising four lenses arranged in an order of a first lens, a second lens, a third lens and a fourth lens from an object side,

wherein the first lens has positive refractive power and has a convex surface facing toward the object side, the second lens has the positive refractive power, the third lens has negative refractive power and has a concave surface facing toward the object side to be formed in a meniscus shape, and the fourth lens has the positive or negative refractive power and has a convex surface facing toward the object side to be formed in the meniscus shape.

2. The image pickup lens of claim 1; wherein following conditional formulas (1), (2) and (3) are satisfied:

$$L/2Y < 1.60 \quad (1)$$

$$0.40 < f_{12}/f < 0.70 \quad (2)$$

$$25 < \{(v_1 + v_2)/2\} - v_3 \quad (3),$$

where L denotes a distance on an optical axis from the object side surface of the first lens to an image side focal point of the whole image pickup lens, 2Y denotes the length of a diagonal line on an effective image screen, f_{12} denotes a combined focal length of the first lens and the second lens, f denotes a focal length of the whole image pickup lens, v_1 denotes an Abbe number of the first lens,

v2 denotes an Abbe number of the second lens, and v3 denotes an Abbe number of the third lens.

3. The image pickup lens of claim 1; wherein an aperture stop is arranged nearest to the object side.

4. The image pickup lens of claim 3; wherein following conditional formulas (4), (5) and (6) are satisfied:

$$L'/2Y < 1.60 \quad (4)$$

$$0.40 < f_{12}/f < 0.70 \quad (5)$$

$$25 < \{(v1 + v2)/2\} - v3 \quad (6),$$

where L' denotes a distance on an optical axis from the aperture stop to an image side focal point of the whole image pickup lens, 2Y denotes the length of a diagonal line on an effective image screen, f₁₂ denotes a combined focal length of the first lens and the second lens, f denotes a focal length of the whole image pickup lens, v1 denotes an Abbe number of the first lens, v2 denotes an Abbe number of the second lens, and v3 denotes an Abbe number of the third lens.

5. The image pickup lens of claim 1; wherein following conditional formulas (7) and (8) are satisfied:

$$-0.40 < R5/((N3 - 1) \cdot f) < -0.20 \quad (7)$$

$$0.30 < f_a/f < 0.50 \quad (8),$$

where f denotes a focal length of the whole image pickup lens, R5 denotes a curvature radius of the object side surface of the third lens facing, N3 denotes a refractive index of the third lens at a d-line, and fa denotes a focal length of an air lens formed by an image side surface of the third lens and the object side surface of the fourth lens.

6. The image pickup lens of claim 5; wherein a following conditional formula (9) is satisfied:

$$-0.40 < R5 / ((N3 - 1) \cdot f) < -0.25 \quad (9).$$

7. The image pickup lens of claim 1; wherein an image side surface of the fourth lens satisfies a following conditional formula (10):

$$X - X0 < 0 \quad (10)$$

for a displacement value X of an aspherical surface expressed in the formula (11):

$$X = \frac{h^2 / R8}{1 + \sqrt{1 - (1 + K8)h^2 / R8^2}} + \sum A_i h^i \quad (11)$$

and a displacement value X0 of a rotational quadratic surface component of the aspherical surface expressed in the formula (12):

$$X0 = \frac{h^2 / R8}{1 + \sqrt{1 - (1 + K8)h^2 / R8^2}} \quad (12)$$

in a range of h satisfying $h_{\max} \times 0.5 < h < h_{\max}$,

where a vertex of the image side surface of the fourth lens is set as an origin, a direction of an optical axis is set as an X-axis, h denotes a height in an arbitrary direction perpendicular to the optical axis, A_i denotes an i -th order coefficient of the aspherical surface for the image side surface of the fourth lens, h_{\max} denotes a maximum effective radius, R_8 denotes a curvature radius of the image side surface of the fourth lens, and K_8 denotes a conic constant for the image side surface of the fourth lens.

8. The image pickup lens of claim 1; wherein the first lens is formed out of glass material, and the second, third and fourth lenses are formed out of plastic material.

9. The image pickup lens of claim 8; wherein a following conditional formula (13) is satisfied:

$$|f/f_{234}| < 0.7 \quad (13),$$

where f_{234} denotes a combined focal length of the second, third and fourth lenses, and f denotes a focal length of the whole image pickup lens.

10. The image pickup lens of claim 8; wherein a saturated water absorption rate of the plastic material is not more than 0.7 %.

11. An image pickup lens comprising four lenses arranged in an order of a first lens, a second lens, a third lens and a fourth lens from an object side,

wherein the first lens has positive refractive power and has a convex surface facing toward the object side, one lens or two lenses selected from the second, third and fourth lenses have the positive refractive power, at least one lens of the positive refractive power selected from the first, second, third and fourth lenses is formed out of glass material,

another lens of the positive refractive power and one lens of negative refractive power selected from the first, second, third and fourth lenses are formed out of plastic material, and

an image side surface of the fourth lens satisfies a following conditional formula (14):

$$X - X_0 < 0 \quad (14)$$

for a displacement value X of an aspherical surface expressed in the formula (15):

$$X = \frac{h^2 / R_8}{1 + \sqrt{1 - (1 + K_8)h^2 / R_8^2}} + \sum A_i h^i \quad (15)$$

and a displacement value X_0 of a rotational quadratic surface component of the aspherical surface expressed in the formula (16):

$$X_0 = \frac{h^2 / R_8}{1 + \sqrt{1 - (1 + K_8)h^2 / R_8^2}} \quad (16)$$

in a range of h satisfying $h_{\max} \times 0.5 < h < h_{\max}$, where a vertex of the image side surface of the fourth lens is set as an origin, a direction of an optical axis is set as an X-axis, h denotes a height in an arbitrary direction perpendicular to the optical axis, A_i denotes an i -th order coefficient of the aspherical surface for the image side surface of the fourth lens, h_{\max} denotes a maximum effective radius, R_8 denotes a curvature radius of the image side surface of the fourth lens, and K_8 denotes a conic constant for the image side surface of the fourth lens.

12. The image pickup lens of claim 11; wherein the lenses other than the lens having the positive refractive power and formed out of the glass material are formed out of the plastic material.

13. The image pickup lens of claim 12; wherein the first lens is formed out of the glass material.

14. The image pickup lens of claim 13; wherein a following conditional formula (17) is satisfied:

$$|f/f_{234}| < 0.7 \quad (17),$$

where f_{234} denotes a combined focal length of the second, third and fourth lenses, and f denotes a focal length of the whole image pickup lens.

15. The image pickup lens of claim 11; wherein a saturated water absorption rate of the plastic material is not more than 0.7 %.

16. The image pickup lens of claim 11; wherein following conditional formulas (18), (19) and (20) are satisfied:

$$L/2Y < 1.60 \quad (18)$$

$$0.40 < f_{12}/f < 0.70 \quad (19)$$

$$25 < v_P - v_N \quad (20),$$

where L denotes a distance on an optical axis from the surface of the first lens to an image side focal point of the whole image pickup lens, 2Y denotes the length of a diagonal line on an effective image screen, f_{12} denotes a combined focal length of the first lens and the second lens, f denotes a focal length of the whole image pickup lens, v_P denotes an Abbe number of the lens having the strongest positive refractive power, v_N denotes an Abbe number of the lens having the strongest negative refractive power.

17. The image pickup lens of claim 11; wherein the second lens has the positive refractive power, and the third lens has the negative refractive power.

18. An image pickup unit comprising:

a solid-state image pickup element having a photoelectric transfer unit;

an image pickup lens for forming an image of an object in the photoelectric transfer unit of the solid-state image pickup element;

a substrate for holding the solid-state image pickup element, the substrate comprising an external connection terminal through which an electric signal is transmitted or received; and

a casing made of a light shielding substance and comprising an opening for incident light entering an object side,

wherein the solid-state image pickup element, the image pickup lens, the substrate and the casing are combined with each other,

a length of the image pickup unit in a direction of an optical axis of the image pickup lens is not more than 15 mm,

the image pickup lens comprises four lenses arranged in an order from the object side, and

the lens arranged nearest to the object side has the positive refractive power.

19. An image pickup unit comprising:

a solid-state image pickup element having a photoelectric transfer unit;

the image pickup lens of claim 1 for forming an image of an object in the photoelectric transfer unit of the solid-state image pickup element;

a substrate for holding the solid-state image pickup element, the substrate comprising an external connection terminal through which an electric signal is transmitted or received; and

a casing made of a light shielding substance and comprising an opening for incident light entering an object side,

wherein the solid-state image pickup element, the image pickup lens, the substrate and the casing are combined with each other, and

a length of the image pickup unit in a direction of an optical axis of the image pickup lens is not more than 15 mm.

20. An image pickup unit comprising:

a solid-state image pickup element having a photoelectric transfer unit;

the image pickup lens of claim 11 for forming an image of an object in the photoelectric transfer unit of the solid-state image pickup element;

a substrate for holding the solid-state image pickup element, the substrate comprising an external connection terminal through which an electric signal is transmitted or

received; and

a casing made of a light shielding substance and comprising an opening for incident light entering an object side,

wherein the solid-state image pickup element, the image pickup lens, the substrate and the casing are combined with each other, and

a length of the image pickup unit in a direction of an optical axis of the image pickup lens is not more than 15 mm.

21. A portable terminal comprising the image pickup unit of claim 18.